ELL-Fate Version 1.2 July 19, 2001

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This spreadsheet based model calculates the decay of a chemical applied to foliar surfaces for single or multiple applications. It uses the same principle as the batch code models FATE and TERREEC for calculating terrestrial estimates exposure (TEEC) concentrations on plant surfaces following application.

A first order decay assumption is used to determine the concentration at each day after initial application based on the concentration resulting from the initial and additional applications. The decay is calculated by from the first order rate equation:

$$CT = Cie\text{-}kT$$

or in integrated form:

$$\ln (CT/Ci) = kT$$

Where

CT = concentration at time T = day zero.

Ci = concentration, in parts per million (PPM) present initially (on day zero) on the surfaces. Ci is calculated based on Kenaga and Fletcher by multiplying the
Ci is calculated based on the Kanaga nomogram (Hoerger and Kenaga, (1972) as modified Fletcher (1994). For maximum concentration the application rate, in pounds active ingredient per acre, is multiplied by 240 for Short Grass, 110 for
Tall Grass, and 135 for Broad leafed plants/insects and 15 for Seeds.
35 for Broad leafed plants/insects. Additional
applications are converted from pounds active ingredient per acre to PPM on the plant surface and the additional mass added to the mass of the chemical still present on the surfaces on the day of application.

k = degradation rate constant determined from studies of hydrolysis, photolysis, microbial degradation etc. Since degradation rate is generally reported in terms of half-life the rate constant is calculated from the input half-life ($k = \ln 2/T1/2$) instead of being input directly. Choosing which processes controls the degradation rate and which half-life to use in terrestrial exposure calculations is open for debate and should be done by a qualified scientist.

T = time, in days, since the start of the simulation. The initial application is on day 0. The simulation is hardwired to run for 365 days.

The program calculates concentration on each type of surface on a daily interval for one year. The maximum concentration during the year and the average concentration during the first 56 days are calculated.

The inputs used to calculate the amount of the chemical present are in highlighted in yellow on the spread sheet. Outputs are in blue. The inputs required are:

Application Rate: The maximum label application rate (in pounds ai/acre)

Half-life:	The degradation half-life for the dominate process(in days)
Frequency of Application:	The interval between repeated applications, from the label (in days)
Maximum # Application per year:	From the label

The calculated concentrations are used to calculate Avian and Mammalian RQ values. The maximum calculated concentration is divided by user input values of Chronic No Observable Adverse Effects Level and acute LC50 to give RQs for each type of plant surface.

The rat LC 50 is calculated by dividing the mammalian LD 50 by 0.05 (to correct for actual food consumption)

For 15g, 35g and 1000 g mammals the RQ values are calculated by dividing the maximum concentration for each surface by the LD 50 or NOAEL corrected for consumption (0.95, 0.66 and .15 body wt. for herbivores and insectivores and 0.21, 0.15 and 0.3 body wt. for granivore)

The number of days that the input value of Chronic No Observable Adverse Effects Level and acute LC50 are exceeded in the first 56 days is calculated by comparing the input value to the calculated concentration.

A graph of concentration on each plant surface vs time is plotted and a "level of concern" line can be added at a user specified level.

The maximum single application which can be applied and not exceed the toxicity input values if calculated by dividing the input value by the Kenaga maximum concentration for Short Grass (240).